PART I - ADMINISTRATIVE

Section 1. General administrative information

Title of project	
Tucannon River Spring Chinook Captive Broodstock Program	
BPA project number	**20020**
Contract renewal date (mm/yyyy)	
Multiple actions? (indicate Yes or No)	
Business name of agency, institution or organization requesting funding	
Washington Department of Fish and Wildlife	
Business acronym (if appropriate)	**WDFW**
Proposal contact person or principal investigator:	
Name	**Joe Bumgarner**
Mailing address	**401 S. Cottonwood**
City, ST Zip	**Dayton, WA 99328**
Phone	**(509) 382-4755**
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Email address	**snakeriv@dfw.wa.gov**
NPPC Program Measure Number(s) which this project addresses	
2.2A, 4.1A, 7.4, 7.4A, 7.4A.1, 7.4B.1, 7.4C, 7.4C.1, 7.4D	
FWS/NMFS Biological Opinion Number(s) which this project addresses	
III.A, III.D.2 (NMFS BO-Hatchery Operations) Linked with 4.4, 4.4.1, 4.4.1a, 4.4.1.b (Snake River Salmon Recovery Plan)	
Other planning document references	
Lower Snake River Compensation Plan (LSRCP) **Snake River Salmon Recovery Team: Final Recommendations** **State of Washington's and Western Washington Treaty Tribes Wild Salmonid Policy** **Wy-Kan-Ush-Mi Wa-Kish-Wit - Volume I**	
Short description	
Modify existing facilities at Lyons Ferry and Tucannon hatcheries to implement a captive broodstock program for Tucannon River spring chinook. Rear and spawn broodstock, raise their progeny and release approximately 120-140 thousand smolts in the Tucannon River to quickly rebuild the run.	
Target species	
Snake River Spring Chinook (Tucannon River stock)	

Section 2. Sorting and evaluation

Subbasin
Lower Snake River - Tucannon River Subbasin

Evaluation Process Sort

CBFWA caucus		CBFWA eval. process		ISRP project type	
X one or more caucus		If your project fits either of these processes, X one or both		X one or more categories	
X	Anadromous fish	X	Multi-year (milestone-based evaluation)		Watershed councils/model watersheds
	Resident Fish		Watershed project eval.		Information dissemination
	Wildlife			X	Operation & maintenance
				X	New construction
					Research & monitoring
				X	Implementation & mgmt
					Wildlife habitat acquisitions

Section 3. Relationships to other Bonneville projects

Umbrella / sub-proposal relationships. List umbrella project first.

Project #	Project title/description

Other dependent or critically-related projects

Project #	Project title/description	Nature of relationship
9401806	Tucannon Model Watershed Program	Provide habitat improvements which may increase in-river survival and aid in recovery of the stock.
8805301	Northeast Oregon Hatchery Master Plan	NEOH is linked with Grande Ronde Basin captive broodstock programs, NEOH co-managers support captive broodstock plans for the Tucannon River and will assist in planning and coordination
8805305	NE Oregon Hatchery Master Plan and Facilities - ODFW	NEOH is linked with Grande Ronde Basin captive broodstock programs
9604400	Grande Ronde Basin Spring Chinook Captive Broodstock Program	Provide expertise and advice in captive broodstock rearing, and assist in overall recovery of Snake River spring chinook

		salmon.
9801006	Captive Broodstock Artificial Propagation	Provide expertise and advice in captive broodstock rearing.
9305600	Assessment of Captive Broodstock Technology	Provide expertise and advice in captive broodstock rearing.
9801002	Captive Rearing Initiative for Salmon River Chinook Salmon - M & E	Provide expertise and advice in captive broodstock rearing, and assist in overall recovery of Snake River spring chinook salmon
9606700	Manchester Spring Chinook Broodstock Project	Provide expertise and advice in captive broodstock rearing techniques.
9801001	Grande Ronde Basin Spring Chinook Captive Broodstock Program	Provide expertise and advice in captive broodstock rearing, and assist in overall recovery of Snake River spring chinook salmon

Section 4. Objectives, tasks and schedules

Past accomplishments

Year	Accomplishment	Met biological objectives?

Objectives and tasks

Obj 1,2,3	Objective	Task a,b,c	Task
1	Initiate and complete facility modifications to Lyons Ferry and Tucannon hatcheries to support captive broodstock program.	1a	Purchase six, 20'(for Lyons Ferry) and four 16'(for Tucannon) circular ponds for rearing captive brood
		1b	Design and implement site preparation and well water hookup at Lyons Ferry and Tucannon Hatchery.
		1c	Purchase plumbing, fencing, and building, and miscellaneous materials to complete facility modification.
		1d	Merging of completed tasks a, b, and c by watering up facility changes and testing.
2	Assist in rebuilding Tucannon River	2a	On an annual basis (for five years

Obj 1,2,3	Objective	Task a,b,c	Task
	spring chinook salmon by creating a captive broodstock program from current hatchery supplementation program broodstock crosses.		starting with 1997 brood fish) Evaluate matings, virology, and BKD screening disease results from current hatchery supplementation broodstock spawning each year.
		2b	Select 15 “family” groups by following selection criteria.
		2c	Select 80 individual fish to represent each “family” unit. Place each family unit into individual rearing ponds (4' circulars).
		2d	At Age 1, decrease each “family” size by randomly selecting 30 individual fish; non selected fish are recombined with supplementation program.
		2e	With CWT’s, VI’s and pelvic fin clips, mark all “family” units uniquely for identification when fish mature and are spawned.
		2f	Split “family” groups between Lyons Ferry (65%) and Tucannon (35%) hatcheries and transfer to larger rearing ponds.
		2g	Within three years, approximately 100-125 captive brood salmon will be spawned annually, producing approximately 200,000 eggs.
3	Increase releases of smolts into the Tucannon River.	3a	Incubate eggs and rear juvenile fish that came from the captive broodstock program separately from the supplementation program fish.
		3b	Externally (pelvic fin clip) and internally mark (CWT) all progeny.
		3c	Transport up to 150,000 captive broodstock progeny to the Tucannon River for acclimation and release at Tucannon Hatchery, Curl Lake Acclimation pond, or direct stream releases (above Tucannon hatchery).
4	Coordinate, compile, analyze and report results.	4a	Disseminate the information collected (oral and written) to other managers working with captive broodstocks.
		4b	Present specific findings to other

Obj 1,2,3	Objective	Task a,b,c	Task technical and public groups.
		4c	Quarterly and annually distribute written data summaries and complete a final written report for distribution to other agencies, tribes, and the public.

Objective schedules and costs

Obj #	Start date mm/yyyy	End date mm/yyyy	Measurable biological objective(s)	Milestone	FY2000 Cost %
1	10/1999	9/2000	Complete facility modifications at Lyons Ferry and Tucannon hatcheries	X	76.0
2	10/1999	9/2000	First collection of eggs from 1997 brood females a possibility	X	17.0
3	NA	NA			0
4	10/1999	9/2000	Compile and disseminate results and conclusions for watershed restoration planning.	X	7
				Total	100.0

Schedule constraints

Depending on when funding is provided (or if funds can be borrowed from the Northeast Oregon Hatchery (NEOH) hatchery production facility and then paid back through this proposal), site design and construction may be delayed because of weather limitations. Other constraints may come from the manufacture of large rearing ponds. It may not be possible for the manufacturer to produce all of the needed ponds in the specified time, and construction costs may be higher than anticipated. If not all ponds can be secured during the contract period, then additional money will be required the following year to complete pond purchases. Objective #2 schedules have already been affected because of our delay in acquiring funding for the project. WDFW has made interim plans to hold the 1997 brood year fish in another location at Lyons Ferry Hatchery until large rearing ponds can be in place. This location is not preferred; we anticipate additional mortalities than what would be expected if we had circular rearing ponds. Further delays into the following brood year will further jeopardize the fish.

Completion date

WDFW has started the captive broodstock with 1997 brood year juveniles. WDFW proposes to collect juveniles through the 2001 brood year. Assuming these juvenile will reach five years in age before maturing, and their resultant progeny will rear for approximately two years before release, the final group of captive brood progeny would be released in the spring of 2008. Funding will be required through FY 2007 to mark all juveniles before release. While final release of juvenile will be release in FY 2008, rearing costs (feed) from 10/2007 to 4/2008 will minimal and will be covered by LSRCP Lyons Ferry operational budget.

Section 5. Budget

FY99 project budget (BPA obligated):	$

FY2000 budget by line item

Item	Note	% of total	FY2000 ($)
Personnel	Hatchery Spec. 30 (6 months), Hatchery Spec. 4 (2 months), Hatchery Complex Manager (1 month) Fish Biologist 3 (2 months)	12.9	36,700
Fringe benefits	Fringe benefits at 28.5% of personnel	3.7	10,460
Supplies, materials, non-expendable property	Pond covers, feed, pond crowding screens, fencing, tools, CWT and VI tags, plumbing pipes and valves	12.8	36,300
Operations & maintenance	Additional well water pumping costs	1.0	3,000
Capital acquisitions or improvements (e.g. land, buildings, major equip.)	Circular ponds (10), open pole building	25.8	73,000
NEPA costs			0
Construction-related support	Site preparation, water hookup	24.7	70,000
PIT tags	# of tags: 0		0
Travel	Attend meetings with other agencies regarding captive broodstocks	0.7	2,000
Indirect costs	Overhead at 22.5%	18.4	52,078
Subcontractor			
Other			
		TOTAL BPA REQUESTED BUDGET	283,538

Cost sharing

Organization	Item or service provided	% total project cost (incl. BPA)	Amount ($)
LSRCP (Lyons Ferry Hatchery complex -	Existing Facilities, share of additional personnel	34.0	$230,690

Tucannon spring chinook program)			
LSRCP (Tucannon spring chinook evaluation)	share personnel time, various monitoring and evaluation efforts of supplementation program will apply to captive brood	24.3	$165,000
		Total project cost (including BPA portion)	$679,228

Outyear costs

	FY2001	**FY02**	**FY03**	**FY04**
Total budget	$75,000	$95,000	$120,800	$125,000

Section 6. References

Watershed?	Reference
	Appleby, A., and K. Keown. 1994. History of White River spring chinook broodstocking and captive brood rearing efforts. Washington Department of Fish and Wildlife, Olympia, WA.
	Bumgarner, J., and H. Harty, G. Mendel, C. Busack, and S. Roberts. 1998. A Proposal for a captive broodstock program with Tucannon River spring chinook salmon (draft). Washington Department of Fish and Wildlife, Snake River Lab, Dayton, WA.
	Hard, J. J., R. P. Jones, Jr., M. R. Delarm, and R. S. Waples. 1992. Pacific Salmon and Artificial Propagation Under the Endangered Species Act - Technical Memorandum NMFS-NWFSC-2, Seattle, WA
	Flagg T. A., and C.V.W. Mahnaken. 1995. An assessment of the status of captive broodstock technology for pacific salmon: Final Report. BPA Project #93-56, Portland, OR.
	Snake River Salmon Recovery Team. 1994 Final recommendation to National Marine Fisheries Service, Portland, OR.
	Smith, C.J., and P. Wampler, editors. 1994. Dungeness River chinook salmon rebuilding project: Progress Report 1992-1993. Olympia, WA.
	Wy-Kan-Ush-Mi Wa-Kish-Wit. 1995. The Columbia River Anadromous fish Restoration Plan of the Nez Perce, Umatilla, Warm Springs and Yakima Tribes, Volume I, Portland, OR.
	Washington Fish and Wildlife Commission. 1997. Policy of Washington Department of Fish and Wildlife and Western Washington Treaty Tribes Concerning Wild Salmonids. Olympia, WA.

PART II - NARRATIVE

Section 7. Abstract

The first step in achieving recovery is to preserve natural genetic variation and population structure by preventing any individual population from going extinct. The Tucannon River spring chinook salmon population represents the lowest geographic spawning population of spring chinook within the Snake River Basin, is genetically distinct from other Snake River populations, and is listed as "threatened" under the ESA. A dramatic decline in the Tucannon River run size and predicted low returns for the next four years will not sustain or rebuild the population to healthy levels, and may create a genetic bottleneck. Based on those criteria, the Tucannon River spring chinook population warrants intervention (in the form of a captive broodstock) as called for in NWPPC's Fish and Wildlife Program and the NMFS Proposed Recovery Plan. WDFW has initiated the NPPC's 3-step Process by drafting an Annual Operation Plan for Lyons Ferry Complex, and a Master Plan for The Tucannon River.

If successful, the captive broodstock program will provide an increased run size, allowing for more natural spawning and genetic selection to occur, broadening the genetic base of the stock as a whole, and increase the chance for stock survival. Th current hatchery supplementation program will not be replaced. The program will continue through FY2007, and will provide an increase in hatchery production (an additional 120,000-140,000 smolts annually) to offset the low returns expected in the next few years. During that time, it is hoped that system survival will improve. Following facility modifications at Lyons Ferry Complex, fish will be raised to adults, spawned, and all or most of their progeny will be released as smolts into the Tucannon River. Adult returns and success of the program will be evaluated under the LSRCP spring chinook evaluation program. Yearly and quarterly updates and a final complete report on the captive broodstock program will be reported to BPA and will be included in LSRCP annual reports for the Tucannon River spring chinook program.

Section 8. Project description

a. Technical and/or scientific background

The Tucannon River basin drains a watershed of approximately 1,295 square kilometers, and contains cropland (dry and irrigated) rangeland, and forests. Natural resource problems include high water temperatures, irrigation diversion, sedimentation, loss or riparian vegetation, and passage problems. Over the past 50 years, farming, livestock management, recreational activities, and catastrophic flood events have degraded the habitat. Objectives adopted by the co-managers include: 1) improve adult pre-spawning survival, 2) improve juvenile survival; and utilize hatchery supplementation to increase natural production. General strategies currently employed to achieve these objectives include improving habitat through instream structures and riparian re-vegetation, passage improvements at barriers, and hatchery supplementation.

Spring chinook salmon populations in the Tucannon River have steadily declined since the construction of the four lower Snake River dams. Historical escapements to the Tucannon Basin were estimated at 2,400 salmon annually, and exceeded 5,000 fish as recently as 1953 (Bugert et

al. 1991). Population declines have been attributed to mortalities of juveniles and adults that occur during migration through the Snake and Columbia Rivers. Habitat loss and alteration in the Tucannon River and variable ocean conditions have also contributed to the decline.

Legislation under the Water Resources Development Act of 1976 provided hatchery compensation for Snake River spring chinook salmon (*Onchorynchus tshawytscha*) mortalities caused by the construction and operation of the four lower Snake River hydro-power projects. As a result, Lyons Ferry Hatchery was constructed and Tucannon Hatchery was modified. One objective of these hatcheries is to compensate for the loss of 1,152 Tucannon River spring chinook salmon. Since 1984, WDFW has evaluated the success of the hatcheries in meeting this objective and has identified production adjustments to improve performance of the hatchery fish. Starting in 1985, WDFW trapped a portion of each annual run of natural fish, and later hatchery fish, for broodstock to use in the hatchery supplementation program. All other returning salmon (natural and hatchery origin) remain in the river for natural spawning and production. The supplementation program requires collection of 100 salmon from the Tucannon River (50 natural and 50 hatchery), to produce 132,000 smolts for release at 15 fish/lb. Since 1993, WDFW has been authorized by NMFS to operate the hatchery supplementation program and has conducted associated research activities on the Tucannon River under a Section 10 direct take permit.

Tucannon River spring chinook runs were relatively stable from 1985-1993 (mean run = 550 fish). However, from 1994 to 1998, the average run declined to 187 fish (range 54-351). In addition to the poor adult returns, floods during the winters of 1996 and 1997, coupled with relatively low redd counts because of the depressed runs, has left the river with little natural production. The estimated number of natural smolts from brood years 1994-1996 averaged less than 3,000 fish annually. Adults returning from those brood years are estimated to total only 50-60 fish. In addition, hatchery production was less than expected to offset low production in the river. LSRCP evaluation studies have determined the natural population of salmon has been below the replacement level for eight of the last nine brood years. Conversely, fish reared in the hatchery program survive about four times better than the natural fish, and have generally been above the replacement level.

WDFW recognizes that unless the limiting factors that are causing the poor survival are alleviated, the population will eventually go extinct. WDFW is hopeful that recent initiatives for habitat restoration in the Tucannon Basin (Tucannon Model Watershed Program), more favorable ocean conditions, and continual adult and juvenile passage improvements at mainstem dams will be enough to return the natural population to above replacement, and the stock will rebound to healthy and stable levels. For all of the above reasons, WDFW believes it necessary to use a captive broodstock to rebuild/recover the Tucannon River spring chinook salmon run.

WDFW has examined other alternatives besides captive broodstock. 1) WDFW could continue current supplementation program at existing levels and try to rebuild the population from the low number of fish currently returning and expected to return over the next few years. This action will essentially 'mine' all remaining wild fish from the river (or those that are trapped) and create a nearly 100% hatchery run. This would not be consistent with ESA requirements or WDFW's Wild Salmonid Policy (WSP). In addition, this action will potentially cause low genetic variability in resulting progeny due to small founder population size, thus creating a bottleneck which may

increase the rate of extirpation. 2) WDFW could introduce a non-endemic stock of spring chinook to the basin for short term to increase the number of spawners in the river for natural production. This action would not be consistent with ESA or WSP. 3) WDFW could increase current hatchery program by trapping more adults from the river. This strategy would fail as there are currently too few adults returning to increase the hatchery production level. The hatchery broodstock goal has not been met in three of the last five years. In addition, more fish would be 'mined' from the river, resulting in less natural production. 5) Initiate captive broodstock program. This strategy will provide the boost in hatchery production (with the appropriate stock) without 'mining' more fish from river. However, multiple outcomes (both positive and negative) are possible, and hatchery practices (spawning, rearing, broodstock selection) need to be carefully planned before proceeding (Flagg and Manhaken 1995).

WDFW, along with the Tucannon River sub-basin co-managers (Nez Perce and Umatilla tribes) believe that a captive broodstock strategy provides the greatest potential for rebuilding or recovering the population in the short-term. Long-term use of a captive broodstock for this population is not recommended. Because of the deleterious effects and potential risks to the population by a long-term use of a captive broodstock (Hard et al, 1992), WDFW proposes this as a short-term project only. Measures proposed to improve system survival need to be acted upon if we hope to succeed in our rebuilding and recovery efforts.

b. Rationale and significance to Regional Programs

This project is supported by various measures in the NWPPC's Fish and Wildlife Program, and was recently support by all managing entities within the Snake River Basin at the Columbia River Fish Management Plan (CRFMP) subbasin renegotiations. The project will support the native run of Tucannon River spring chinook salmon in its native habitat(2.2A), and will contribute to the rebuilding of the Snake River spring chinook salmon run(4.1A). As stated under the Council's salmon and steelhead rebuilding principles(4.1A); 1) priority should be given to activities that aim to rebuild weak upriver populations, including populations listed under the ESA, 2) this project will be linked to a Model Watershed Program in the Tucannon River, and 3) that while additional production facilities are not recommended by the Council, the current facilities used for the hatchery supplementation program will not be able to satisfy the need of the fish and achieve the goals. This project represents a new production initiative(7.4, 7.4A, 7.4A.1); therefore, WDFW will satisfy the terms of the NPPC's 3-step Process by developing a Master Plan (7.4B, 7.4B.1) for the Tucannon River basin and Lyons Ferry Complex. WDFW believes this to be an emergency case (7.4C, 7.4C.1), where unless intervention takes place quickly, the population will be beyond recovery. While captive broodstock can be risky (genetic integrity, catastrophic facility failures, etc..), they also have the potential to rapidly increase adult fish numbers. Implementation of a captive brood stock program may be the most effective means of accelerating recovery of this depleted stock, and if held in captivity for no more than a single generation (as currently planned), genetic integrity and adaptability should be preserved (7.4D).

NMFS's Proposed Recovery Plan for Snake River salmon states 'Captive broodstock is primarily a procedure to prevent extinction.'. Further, 'Captive broodstock, gene banks and other supplementation programs should be considered for use in helping to conserve and maintain selected discrete populations until the predominating factors for decline can be alleviated'. NMFS

has concluded that '..technology is sufficiently developed for Snake River captive broodstock programs to proceed', and could be considered for use in recovery programs when: 1) Extinction of a population is imminent or the population is at risk of severe inbreeding depression, 2) facing demographic risks; or 3) other methods of propagation are not expected to yield population stability in a timely manner. All of those conditions exist for the Tucannon River spring chinook population.

A captive broodstock for Tucannon River spring chinook salmon is consistent with the broad based goals stated in the tribal recovery plan (Wy-Kan-Ush-Mi Wa-Kish-Wit 1995). A successful captive broodstock program will in the short term restore the depressed spring chinook to at least pre-1994 levels and in their historical range. In addition, by returning more adults to spawn, the Tucannon River will be able to rely once again on natural production to assist in recovery. By successfully returning more adults, there will also be a greater opportunity to provide tribal fishery harvests, honoring treaty rights. In addition, captive broodstock programs for Snake River spring/summer chinook are supported by recommendations in the Snake River Salmon Recovery Team's report (SRSRT 1994).

Hatchery supplementation efforts in the Tucannon River under the LSRCP have not been able to overcome the recent limiting factors (droughts, floods, and poor ocean conditions), though it does not mean the program has failed. The proposed captive broodstock program will not replace the current hatchery supplementation program. The annual juvenile production goal for captive broodstock progeny is 100,000 smolts to be released at 10-12 fish/lb, in addition to the current supplementation program of 132,000 smolts released at 15/lb. Smolt releases of this magnitude should return adult numbers to Pre-1994 levels.

The information gained from this captive broodstock program will enable the scientific community to better utilize hatcheries as a recovery tool for other threatened and endangered stocks of salmon in the Columbia and Snake River basins. This proposed project has been developed by the WDFW (1998) and supported by the U.S. Fish and Wildlife Service (LSRCP), and by co-managers (Nez Perce and Umatilla Tribal fishery agencies) within the Tucannon River subbasin.

c. Relationships to other projects

The Tucannon River Model Watershed Program (Project #9401806), will play a critical role in improving habitat conditions in the Tucannon River basin. While habitat conditions in the major rearing areas of spring chinook in the Tucannon River are considered good, improvement to the watershed in marginal areas will increase the range where spring chinook can rear. Other Washington State funded initiatives (HB2496) for watershed restoration activities will also improve habitat (reduced water temperatures, increased woody debris, etc..) conditions in the

Tucannon River basin. These habitat restoration efforts should ultimately improve spring chinook salmon survival and run sizes.

Other related projects (#9604400 - Grande Ronde Basin spring chinook Captive Broodstock Program, #9801001 - Grande Ronde Basin spring Chinook Captive Broodstock Program, #9801006 - Captive Broodstock Artificial Propagation, #9305600 - Assessment of Captive Broodstock Technology, #9801002 - Captive rearing Initiative for Salmon River Chinook Salmon - M& E, #9806700 - Manchester Spring chinook Broodstock Project) will play important coordination roles in sharing learned information regarding captive broodstock rearing and techniques. Failures and successes learned by these programs will benefit the Tucannon River captive broodstock program. Success within this program will also benefit other captive broodstock programs. Captive broodstock programs for the Grande Ronde River and the captive rearing project for the Salmon River, and the Tucannon River project, are all attempting to rebuild, recover, or conserve a listed spring or summer chinook population within the Snake River Basin.

Due to a delay in WDFW acquiring funding for this project, the tribal co-managers within the Tucannon River basin have requested temporary diversion of BPA funds from Northeast Oregon Hatchery (Project #'s 8805301 and 8805305) to initiate construction and facility modifications at Lyons Ferry and Tucannon hatcheries as soon as possible. This transfer (and eventual payback) of funds through NEOH will provide a critical linkage with the captive broodstock programs in the Grande Ronde Basin.

In addition to these Snake River basin related projects, WDFW has extensive expertise and experience with captive broodstock programs within the State of Washington from the Dungeness River (Smith and Wampler 1994) and the White River (Appleby and Keown 1994). Proven and successful operations from these two programs will be incorporated into the Tucannon River captive broodstock plan.

d. Project history (for ongoing projects)

Not Applicable at this time.

e. Proposal objectives

The overall goal of this proposed captive broodstock program is to quickly rebuild the number of adults returning to the system. It will be critical to use progeny from the next few broods years because of the projected low run sizes. Without increasing the number of progeny from those original brood years, there will be little chance the stock will rebound. These returning adults from the captive broodstock population will be allowed to spawn in the river, allowing natural selection to determine fitness of the resulting population. Four broad based goals were identified for the project: 1) initiate and complete facility modifications to Lyons Ferry and Tucannon hatcheries to support captive broodstock program, 2) assist in rebuilding Tucannon River spring chinook salmon by creating a captive broodstock program from current hatchery supplementation program broodstock crosses, 3) increase releases of smolts into the Tucannon River, and 4) disseminate the information collected to other managers working with captive broodstocks.

Objective #1: Facility modifications will have to take place for this project to be successful. The State of Washington has one of the largest hatcheries program in the world with highly qualified people in fish culture, hatchery design and construction. The facility modifications identified to rear the captive broodstock are minor, and should easily be accomplished by WDFW's engineering and hatchery maintenance crew. Once complete, Lyons Ferry will have six 20' circular rearing tanks (fiberglass) for rearing spring chinook salmon in. Tucannon Hatchery will have four 16' circular rearing tanks. Facility modifications will be relatively simple once funds are obtained. Expected delays in facility modifications may occur due to poor weather or rearing tanks not being manufactured in time.

Objective #2: WDFW has initiated the captive broodstock program with 1997 brood fish, even though funding for the program had not been fully identified. In 1995, WDFW had proposed a captive broodstock program with 1995 brood year fish, but ceased operations because it looked as if the stock was going to rebound on its own. Because of the initial steps taken in 1995, WDFW currently has 15 four foot rearing tanks on station at Lyons Ferry. These 15 tanks are currently rearing unique "families" from the 1997 brood year. All of these "families" came from the 1997 eggtake collection from the supplementation program. Fifteen unique "families" will be chosen for the next four brood years.

Fish will be raised to maturity in the larger rearing ponds once they have been constructed and set up at Lyons Ferry and Tucannon hatcheries. Based on survival assumptions, WDFW anticipates that 100-150 females may be spawned in a given year (assuming three different brood years mature at the same time). Throughout their rearing cycle, periodic samples will be collected to monitor growth and maturity rates of these fish. In addition, specific "family" groups will be monitored for survival differences, disease incidence, etc.. .

Objective #3: The program is projected to produce about 250,000 eggs on an annual basis once three brood years have obtained maturity. With an egg viability of 70% and fry to smolt survival rate of 70-80%, WDFW has estimated 120,000-140,000 smolts will be available for release into the Tucannon River. Smolt production of that magnitude will double the current spring chinook smolt releases into the Tucannon River. Based on smolt to adult survival rates of hatchery spring chinook in the Tucannon River, WDFW estimates that 240-280 adult fish will return from each brood year. Combining that with the hatchery supplementation program, spring chinook runs in the Tucannon River should once again reach 500-600 fish/year.

Objective #4: Critical to the success of this project will be the two-way information exchange between other captive broodstock programs. Success and failures documented from other programs will be vital to our success. It will also be important to inform the general public about our recovery efforts for the Tucannon River. All information learned under the captive broodstock program will be shared with other agencies through technical meetings and possible peer reviewed journal articles.

f. Methods

WDFW proposes two separate rearing locations for the captive broodstock (Objective #1).

Option #1 utilizes both Lyons Ferry and Tucannon Hatchery, and is the most preferred, as it reduces the risk of catastrophic loss. Since Tucannon River spring chinook are currently transferred between the two hatcheries, this alleviates many Fish Health concerns. Option #2 rears all fish at Lyons Ferry, greatly increasing the risk of failure due to a disease outbreak (such as BKD) or water system failure. While Option #1 is preferred, Option #2 will be selected if the allocated funding amount is less than required to make the appropriate facility changes.

Each hatchery will be slightly modified (Objective #1). WDFW engineering and hatchery maintenance crews will be used to modify the facilities. Both of these crews have experience in designing and constructing other captive rearing facilities in the State of Washington. At Lyons Ferry Hatchery, a greenest area next the main hatchery building will be prepared for the large rearing ponds. Rearing ponds destined for Tucannon Hatchery will be placed within an existing fenced area, and connected to the existing well water supply. Six 20' and four 16' circular rearing ponds (fiberglass construction) will be connected to the existing water supply at Lyons Ferry and Tucannon, respectively. Pond covers and fencing for security will be constructed. Fifteen initial rearing/starter tanks have already been established at Lyons Ferry Hatchery and are currently rearing fish (1997 brood year). Lyons Ferry Hatchery is a 100% pathogen free well water facility, with a constant water temperature of 11^{o}C. Tucannon Hatchery has pathogen free well water, in addition to spring and river water. Due to potential disease concerns from spring or river water, only well water will be used for the captive broodstock. The hatcheries are staffed 24 hours a day with on-station hatchery personnel. Water, power and other critical elements of operation are wired to an audible alarm. Backup power and water supplies are available for both hatcheries.

The egg/juvenile source to initiate the captive broodstock program will come from the current supplementation program in the hatchery (Objective #2). No juvenile natural-origin fish will be collected from the Tucannon River to create or supplement the captive brood population. WDFW believes this may be a benefit as we don't have to get more fish from the river, and we have a disease history of every fish that contributes to the program. Since Bacterial Kidney Disease (BKD) has been a problem with chinook captive broods (Dan Witzack pers. comm.), we hope to alleviate BKD problems by our selection criteria. Under current spawning guidelines, eggs from an individual female are split into two lots. Each egg lot is then fertilized by a different male to increase genetic diversity, and provide insurance against non-viable males. The same two males are then used on another female. Eggs from each female are incubated separately. Because of the fertilization process, progeny from those two females are half-sibling related. To reduce the potential of half-sibling crosses when the fish mature, and to increase the overall effective population that originally contributed to the captive broodstock, females fertilized with the same two males are combined to create a "family" unit.

Initially, eighty juveniles will be selected from each "family" group, which will later be reduced to 30 fish/family. Fifteen individual families will be selected based on the following criteria; 1) based on BKD screening (ELISA results) of females and 2) origin of parents. Only females which were given a "Low" or "Below Low" ELISA result will be selected. Priority is given to females that are crossed Wild x Wild, Wild x Hatchery, and Hatchery x Hatchery, in that order. During each spawning year, great efforts are made to avoid hatchery x hatchery crosses, which could contribute to domestication of the stock. Generally, selected progeny in the captive broodstock will represent 60 spawned fish from the supplementation program, with only one or two

"families" at most that are full second generation hatchery origin.

The captive broodstock program goal has been set at 120,000-140,000 smolts/year, or 250,000 eggs assuming 70% egg viability, and 20-30% mortality to smolt (Objective #3). Survival rates of captive fish are relatively unknown, though we speculate a 50% survival based on WDFW experience at Hurd Creek Hatchery (Dan Witzack, Hurd Creek Hatchery Manager, pers. comm 1998). Assuming a mean fecundity of 1,800, 2,200 and 2,500 eggs/female for Age 3, 4 and 5 respectively, about 100 females would be required to reach the eggtake and smolt goal on an annual basis.

The 30 fish selected from each tank will be uniquely marked by "family" (Objective #2) and then split and transferred to larger rearing tanks at Lyons Ferry (60-65%) and Tucannon Hatchery (35-40%). Marking captive brood fish will consist of a CWT in the snout and adipose fin, an alphanumeric Visual Implant (VI) tag behind the left or right eye, and some families (7 or 8) will receive a pelvic fin clip. Redundancy in marks and tags will allow for tag loss and will provide quick identification during spawning.

Once the fish have been transferred to the larger rearing tanks, they will not be moved again unless survival rates are greater than anticipated, and density limits are exceeded. Extra measures will be taken to limit human contact as much as possible (pond covers, minimal cleaning). As adults mature at each facility, fish that indicate they will spawn that year will be transferred (from Tucannon Hatchery if held there) back to Lyons Ferry in a separate adult holding raceway. To increase the genetic variability of the progeny, 2x2 or 3x3 crosses will be performed (identical procedure as in the hatchery supplementation program). If spawn timing between the captive broodstock and the supplementation fish are similar, gametes may also be shared between the two to increase variability. In addition, cryopreserved semen (that has been tested for fertilization success) collected since 1990 from wild origin Tucannon spawners may be utilized to increase genetic variability. If the number of maturing adults exceed program goals, some may be released into the Tucannon River to spawn naturally. Or, if juvenile production goals are exceeded, extra fish have been proposed, by WDFW, for re-introduction of spring chinook into Asotin Creek. The Asotin Creek spring chinook population is believed to be extinct.

Following fertilization, eggs will be placed in Heath incubation trays. Chilled water may be used to align spawn dates together to synchronize the time at which progeny are ponded. Chilled water will not be used to significantly slow the development of the embryos as in the supplementation program. It is estimated that fish will be released at approximately 10-12 fish/lb. All captive broodstock progeny will be reared in standard raceways at Lyons Ferry Hatchery, but will be separated from the hatchery supplementation program until marking is complete. WDFW is currently examining the possibility of creating natural rearing conditions for juveniles reared at Lyons Ferry. This may involve adding substrate and covers to standard raceways. Following marking, some or all of the captive broodstock progeny will be mixed with the supplementation program fish.

All captive brood progeny (objective #3) will be marked in September (approximately Age 1). It is unknown at this time what specific marks/tags will be given to the fish, though it will likely include an adipose fin clip, CWT, and pelvic fin clip. The pelvic fin clip will be necessary for

external identification purposes. The pelvic fin clip will allow hatchery personnel to avoid collection of captive brood progeny fish for the supplementation program. Following marking, all captive broodstock progeny will be transferred to Tucannon Hatchery. In late February or early March, a portion or all of the captive brood progeny will be transferred to Curl Lake or to remote acclimation sites upstream of the hatchery for a minimum of three weeks acclimation. Some of the fish may be held at Tucannon Hatchery until late March or early April, then transported upstream and direct stream released into the upper watershed.

g. Facilities and equipment

Lyons Ferry and Tucannon Fish hatcheries are pre-existing spawning, rearing and release facilities with on-station personnel housing and tanker trucks for moving fish. The existing supplementation program is fully funded under the LSRCP mitigation program for Snake River spring and fall chinook salmon and steelhead. Each facility has space and pathogen free water supplies to accommodate the proposed action. The increase in juvenile production from the captive broodstock program will not dramatically effect the rearing capacity of either hatchery, though some minor production adjustments of other programs may be required. Each hatchery will require only a small amount of modification for the captive broodstock program. WDFW engineering and hatchery maintenance crews will be used to design and conduct the site preparation and plumbing modifications for each hatchery. Specific equipment needed will include plumbing materials, large fiberglass rearing ponds, pond covers, basic aquaculture supplies (nets, crowders, pond covers, etc..), and fencing for security. Most of these will be a one time cost to the program, with personnel time, juvenile marking, and operation and maintenance cost for the remaining years. Marking trailers (for marking broodstock and resultant progeny) will be supplied by WDFW, though tags (CWT, VI) and marking personnel salaries will be provided under the captive broodstock program.

h. Budget

The total estimated cost for FY2000 is $283,538. Facility modifications (site preparation, fencing and plumbing) and capital acquisitions (circular ponds, pole building) will require about $179,000, or 63% of the requested funds. Since the proposed plan is short term, and WDFW is keeping cost as low as possible, we have recommended using fiberglass rearing ponds (about $6,000 per pond). While existing personnel are on station and will conduct similar duties, WDFW estimates care of captive brood fish will require an additional 2-3 hours per/day (total for both facilities). Additional personnel time will be required for marking and transporting broodstock, broodstock selection, and spawning, etc.... . For those purposes we have requested six months of a hatchery culturist personnel time. In addition, WDFW request personnel time for a biologist, hatchery manager and Lyons Ferry hatchery complex manager to attend coordination and planning meetings with co-managers, and to oversee site modifications. Also included in that time is for monitoring and evaluation of captive broodstock fish throughout their life cycle. After the initial major purchases to modify the facilities, the cost of the captive brood program will be less than $100,000 for FY2001 and FY2002, with personnel salaries, benefits and administrative overhead comprising 77% and 61% of those years' budgets, respectively. The cost of the project will increase as captive brood progeny become available for marking and eventual release. Projected annual costs are estimated to remain less than $125,000/year for the remainder of the project.

Cost sharing will play a major role in the success of this project. Based on annual operating and evaluation budgets for the Tucannon spring chinook program, LSRCP will contribute up to 58% of the FY2000 budget for the entire spring chinook program at Lyons Ferry Complex (supplementation, captive brood, and evaluations). LSRCP will play a vital role in monitoring and evaluating the Tucannon spring chinook adult run long after all of the captive brood juveniles have been released and the hatchery rearing portion of the project has been completed.

Section 9. Key personnel

Other WDFW hatchery managers, fish biologists, fish hatchery specialists, and scientific technicians supervised by individuals listed below may also participate in propagation of captive broodstock fish. WDFW's Geneticist and Fish Pathologists will also be involved during various aspects of this project.

Joseph D. Bumgarner - Principle Investigator

EDUCATION:

M.S. (Fisheries)	June, 1993 University of Washington, Seattle, WA
B.S. (Fisheries)	December, 1987 University of Washington, Seattle, WA

WORK HISTORY:

June, 1993 to present Washington Department of Fish and Wildlife, Dayton, WA
Fish Biologist II and III - Responsible for identifying, designing, conducting, analyzing, interpreting, and reporting appropriate research for Lower Snake River Compensation Plan (LSRCP) for spring chinook mitigation in southeast Washington. Relate findings to LSRCP and fish management needs in area rivers. Performs as the WDFW spring chinook specialist for the LSRCP program. Takes primary responsibility for the organization, writing and data analysis for annual Tucannon spring chinook salmon report. Assists in routine professional biological work related to spring and fall chinook salmon production and evaluation at Lyons Ferry Hatchery.

PROJECT EXPERTISE:
Current duties include acting as WDFW's lead fisheries biologist for all spring chinook monitoring and evaluation in the Tucannon River under the LSRCP. Developed draft captive broodstock proposal for Tucannon River spring chinook salmon. Familiar with basic aquaculture and captive broodstock rearing techniques. Assist Lyons Ferry Hatchery in current spawning activities and tracking of spring chinook matings. Duties will be to compile disease and mating records for captive broodstock progeny selection. Assist in tagging and spawning of adult broodstock and all record keeping. Disseminate information to other agencies and organizations.

RECENT REPORTS:
Bumgarner J.D. 1998. Washington's LSRCP Spring Chinook Program - Tucannon River. In:: Proceedings of the Lower Snake River Compensation Plan Status Review Symposium. Compiled by the U.S. Fish and Wildlife Service, Lower Snake River Compensation Plan Office, Boise,

Idaho. September 1998. 276p.

Bumgarner, J., D. Milks, L. Ross, and M. Varney 1998. Tucannon River Spring Chinook Hatchery Evaluation. 1997 Annual Report, #H98-06 to U.S. Fish and Wildlife Service, LSRCP Office, Boise, ID.

Harold R. Harty - Associate Investigator

WORK HISTORY:

1995 to present Washington Department of Fish and Wildlife, Starbuck, WA

Lyons Ferry Complex Manager - Manages a multi-species fish hatchery complex (Lyons Ferry and Tucannon Hatcheries), and maintains three satellite acclimation facilities. Responsible for fish culture and biological program planning; budget development and tracking; supervision of full time and temporary employees; coordination and supervision of permitting and engineering efforts associated with hatchery operation and maintenance. Coordination with various state and tribal agencies for marking and releases of spring and fall chinook salmon, steelhead trout and rainbow trout.

1979-1995 Washington Department of Wildlife, Statewide locations

Fish Hatchery Manager II, III, and V - Managed multi-species fish hatcheries within the state of Washington. Responsible for fish culture and biological program planning; budget development and tracking; supervision of employees; coordination and supervision of permitting and engineering efforts associated with hatchery operation and maintenance. Coordination with various state agencies for marking and release of rainbow and steelhead trout. Organized, planned and executed spawning procedures and shipments of eggs to various hatcheries throughout the state; stocking of fish in lakes and stream within the region. Successfully fulfilled enforcement, biological and wildlife management requirements of the jobs.

PROJECT EXPERTISE:

Assisted in the development of the draft captive broodstock proposal for Tucannon River spring chinook salmon. Provided critical information regarding hatchery and fish limitations. Over 25 years of experience in basic and advanced aquaculture techniques. Familiar with captive broodstock rearing techniques. Directs Lyons Ferry Complex personnel in current spawning activities and juvenile rearing. Specific duties will be to oversee captive broodstock program and personnel associated with the captive broodstock program at Lyons Ferry complex. Assist with tagging and spawning of captive broodstock.

RECENT REPORTS:

Harty, H. R. 1997. Lyons Ferry Complex Annual Report to U.S. Fish and Wildlife Service, LSRCP Office, Boise, ID.

Section 10. Information/technology transfer

WDFW will report the findings of this study in quarterly and annual reports to BPA, annual publications for the LSRCP, and, upon total completion of the project as a publication in a refereed journal. Oral presentations will be made at regional and public meetings, a captive broodstock technical working group for the Snake River Basin, and at American Fisheries Society meetings.

Congratulations!